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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/734,389	12/12/2003	Byung Seok Lee	29936/39885	9757

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EXAMINER

LEE, CALVIN

ART UNIT	PAPER NUMBER
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2818

DATE MAILED: 02/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

05

Office Action Summary	Application No. 10/734,389	Applicant(s) LEE, Byung Seok	
	Examiner Calvin Lee	Art Unit 2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____ | 6) <input type="checkbox"/> Other: ____ |

OFFICE ACTION

Claim Rejections - 35 U.S.C. § 103

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 103 that form the basis for the rejections under this section made in this Office action:

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 2, and 6-9 are rejected under 35 U.S.C. 103(b) as unpatentable over *Applicant's Prior Art (APA)* in view of *Huang (US 6,150,073)*.

APA discloses a method for forming a bit line of a flash device, comprising the steps of:
-forming a barrier film 14 and an interlayer insulation film 16 on a semiconductor substrate 10
-forming a photosensitive film pattern 18 for opening a bit line area
-forming a bit line trench 20 [Fig. 3B]
-forming a bit line metal film to bury the bit line trench
-removing the bit line metal film and the photosensitive pattern on the insulation film [Fig. 3C]

a) *APA* however does not suggest using a metal hard mask. Nevertheless, such metal hard mask is known in the semiconductor processing art as evidenced by *Huang* disclosing to pattern a tungsten hard mask 214 [Fig. 2B and col. 3], and to etch an interlayer insulation film 204 and a barrier film 212 using the hard mask pattern as a mask [Fig. 2D].

It would have been obvious to a person of ordinary skill in the art to have modified the process of *APA* by utilizing a metal hard mask, taught by *Huang*, for the purpose of preventing damages (e.g., jagged profile, etc.) of trench sidewalls of the etched inter-insulating layer [col. 1].

b) In re claim 6, *Huang* suggests the tungsten hard mask having thickness of about 300-500Å

3. Claims 3 and 4 are rejected under 35 U.S.C. 103(b) as unpatentable over *Applicant's Prior Art* in view of *Huang*, as applied to claim 1, and further in view of *Levy et al (2004/0142557)*.

APA discloses cleaning the bit line trench 20 ["cleaning process prior to the process of burying metal," ¶ 0011]. *Huang* suggests a "remove process, such as oxygen plasma ashing or wet chemical cleaning" [col. 3, ln.31]. *Levy et al* explicitly teaches "preclean by sputter etch (Ar or Ar-H₂) or a reactive clean (F, F₂, NF₃, CF₄, etc)" [¶ 0055].

It would have been obvious to a person of ordinary skill to have modified the cleaning process of *APA* by utilizing a preclean by sputter etch or a reactive dry clean for the purpose of removing native oxides and other contaminants (e.g., residues) from vias.

4. Claim 5 is rejected under 35 U.S.C. 103(b) as unpatentable over *Applicant's Prior Art* in view of *Huang*, as applied to claim 1, and further in view of *Hawley et al* (2003/0205723).

Huang suggests forming a glue/barrier layer 208 followed by a bit line film 210, wherein the bit line film 210 comprises copper, aluminum, or aluminum copper, but not tungsten (the material used to form the hard mask 214). Examiner notes that in *Huang* the glue/barrier layer comprises at least tungsten, which has a direct contact to the tungsten hard mask and the trench. Nevertheless, such tungsten bit line is known in the semiconductor processing art as evidenced by *Hawley et al* disclosing a tungsten bit line 20 and a tungsten hard mask 28 [Fig. 1 and ¶ 0045]. Moreover, *Hawley et al* also teaches using "tungsten hard mask provides high etch selectivity and the possibility to etch barrier metals without affecting the dielectric constant and mechanical properties of the antifuse material" [Abstract].

It would have been obvious to one of ordinary skill in the art to combine the teachings of *APA*, *Huang*, and *Hawley et al*, and thus arrive at the claimed invention, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 SUPQ 416.

Furthermore, it appears as if any metal fill including the claimed materials would work equivalently to any other well-known metal fill as long as the desired metal material has a higher etch rate than the surrounding layer (i.e., the inter-insulating layer).

Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at (571) 272-1896 from 7:00AM to 5:00PM (Monday-Thursday, Eastern Time). If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2825's Supervisory Patent Examiner *David C. Nelms* can be reached at (571) 272-1787.

Any inquiry relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0596. The central fax number is (703) 872-9306 for all communications to be entered (e.g., amendments, remarks, IDS, etc.)



January 31, 2005